Resource Reallocation Considerations for the NYPD Based on Crime Activity

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Dihman Sarkar
Principal Data Scientist

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Executive Summary

This project is focused on examining crime activity in the New York City Area. Throughout the years the crime rate in NYC has significantly gone up, making it a risk prone place to live for the civilians. So, we collected the New York City Police Department's crime dataset and filtered our data elements to study the historical data up to 2020.

After scrubbing and cleaning up the dataset by checking for duplicates and excluding entries with missing values we imported our clean dataset into Arc GIS and conducted our analysis. Upon our analysis, we were able to successfully analyze and identify the high crime rate areas and map them in the New York City Map. Having

visual representation of numeric data allowed us to identify the hot spots and the allocation of the various NYPD service centers with respect to their service areas. The study will allow the New Your City Police Department to decide their service radius along with strength of the individual units. This will be determined based on the crime types and seriousness of the offenses. Analyzing the patterns would facilitate in effective allocation of the resources and containing the criminal activities in New York City. As a result, it would increase the operational efficiency of the police department and increase their crisis management capabilities.

Introduction

In this analysis, we have used New York crime data from New York City Open Data provided by the New York City Police Department. We narrowed down our data to only include crimes from January 1, 2019 to September 30, 2020 (Most recent data available). The data set contains geographical data regarding violations, misdemeanors, and felonies that indicate the location of the crime's occurrence. This data will allow us to identify specific areas with a higher amount of crime, so that we can strategically place police departments and/or service areas to maintain these areas more effectively. The purpose of this analysis is to provide an understanding of areas with higher risks of crime, so that city officials can work together with police departments to implement strategies and deploy their resources in a way that will minimize the risk of crime and improve the safety of New York's residents.

The objective of this analysis is to gain an understanding of the locational occurrence of crime in general and by its classification. The reason for this analysis has become apparent recently in that New York has observed a spike in violent crime this

year. According to the New York City Police Department, "the number of people victimized by gun violence and murder in New York City spike significantly, when compared to the same period in 2019" (NYPD, 2020). This map will provide the understanding necessary for police departments to deploy their officers and use their resources in locations that have been identified to exhibit a higher risk of crime.

It is vital in today's day and age for city officials and the police to adapt to the times in terms of technology usage. The geographical maps and spatial analysis included in this report will generate a large advantage for the city of New York as they fight crime. In addition, this will allow police to work much more efficiently in that they will be able to respond quicker to locational and/or environmental changes regarding crime.

Problem Statement

Through analyzing the data we stumbled upon a few challenges that we collectively decided to address and find the best possible approach in order to come up with solutions. First, by looking at the New York Police Department's Complaint Dataset, it was important to understand what areas are more prone to a higher crime rate and requires stricter law enforcement. Hence, identifying crucial zones that have high rate of complaints and a crime rates can be categorized as hotspots. Based on the identified hotspots, it would be ideal to have the NYPD deploy their units and/or shift their service areas closer to cover the areas that needs more attention. Creating a visual representation of the data will be highly instrumental in segmenting the various regions. Therefore, it is important for us to answer a few questions through the analysis that will help in filling in the perspective to handle the resources of the NYPD better and yet make the neighborhood in New York City a safer place to live. Some of the exploratory questions that we look forward to address are the following:

- How can we map the hotspots with a high crime rate in NYC?
- Are there any additional datasets that we need to incorporate into our primary data for an in-depth study? If so what datasets do we require?
- Where should the units be more strategically dispatched?
- What preventive and prescriptive measures can be taken to lower the crime rate?

Since we are trying to focus on the mapping the hotspots for high crime rates based on the latitudinal and longitudinal data, Arc GIS appeared to be the best tool in

order to map our location's radii. This would help us in visually analyzing the information and solve our problem statement.

Study Area

Our study area has been set to the perimeters of New York City. As we progressed through the project we became more and more specific, breaking-down our NYC map by borough and census tract. We eventually outlined police precinct borders as well. The reasoning for selecting New York is due to interest as well as importance. New York is a very popular city globally, however it has been known to experience large amounts of crime. Police brutality is also a very real and long existing issue across this country, and NYC is no exception. Additionally, the NYPD has come under intense scrutiny for its massive budget, while communities and education are being stripped of funding. According to Gotham Gazette, while the NYPD received $5.9 billion in funding, "the Department of Youth and Community Development (DYCD) saw a 32% cut in its proposed budget." We hoped our analysis could potentially provide insights and considerations into the current allocation of police resources within NYC.

Study Area Map:
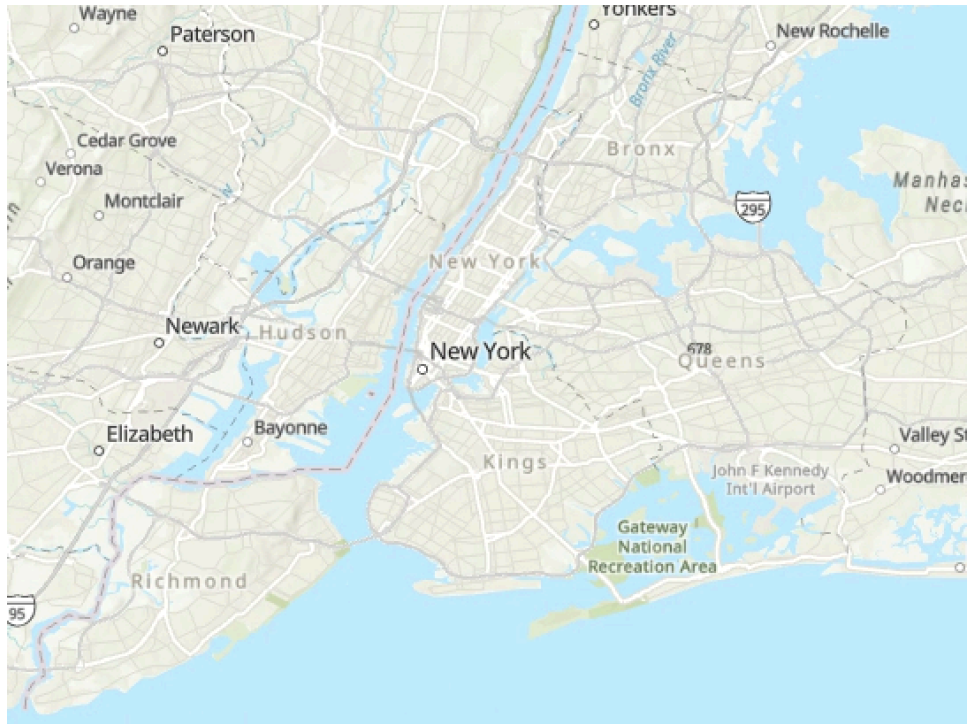
Data Selection and Acquisition

It was challenging to find an appropriate dataset on Kaggle because none of them contained the exact information we were looking for (specific columns, # of rows, etc.). However, after some research, we found the NYC Open Data website, which allowed us to extract datasets that were specific to our study. The dataset we ultimately chose to use was Current NYPD Complaint Data. It was provided by the NYPD and included all valid felony, misdemeanor, and violation crimes reported to the New York City Police Department for the years 2019 and 2020. To turn our dataset into points, we used the XY table to point tool.

Map with NPYD Complaint Data Current
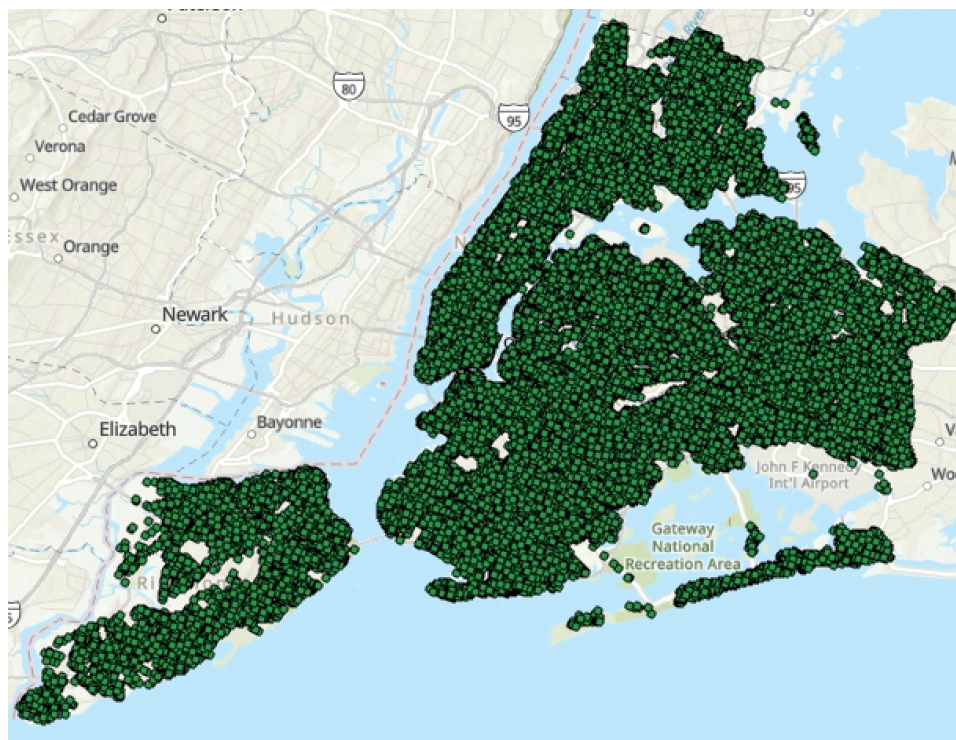
However, we found there was a collection of outlier complaints dated from the early 1900s through 2018. In our final analysis, we opted to filter out points occurring before January 1, 2019, as they were not current or relevant, and we were worried they could have an influence on our findings. Additionally, there were many null values in the Borough column of the dataset, which was crucial for our analysis. Thus, we also obtained a shapefile including all Borough Boundaries in the New York City area, which was also found on the NYC Open Source Data website. After exporting the shapefile and adding it to our map, we then combined our original dataset with the borough polygon using a spatial join. We immediately didn't like how the borough polygon covered our map, so we changed the symbology of the borough polygon to a thick black border to better visualize where our points are located.
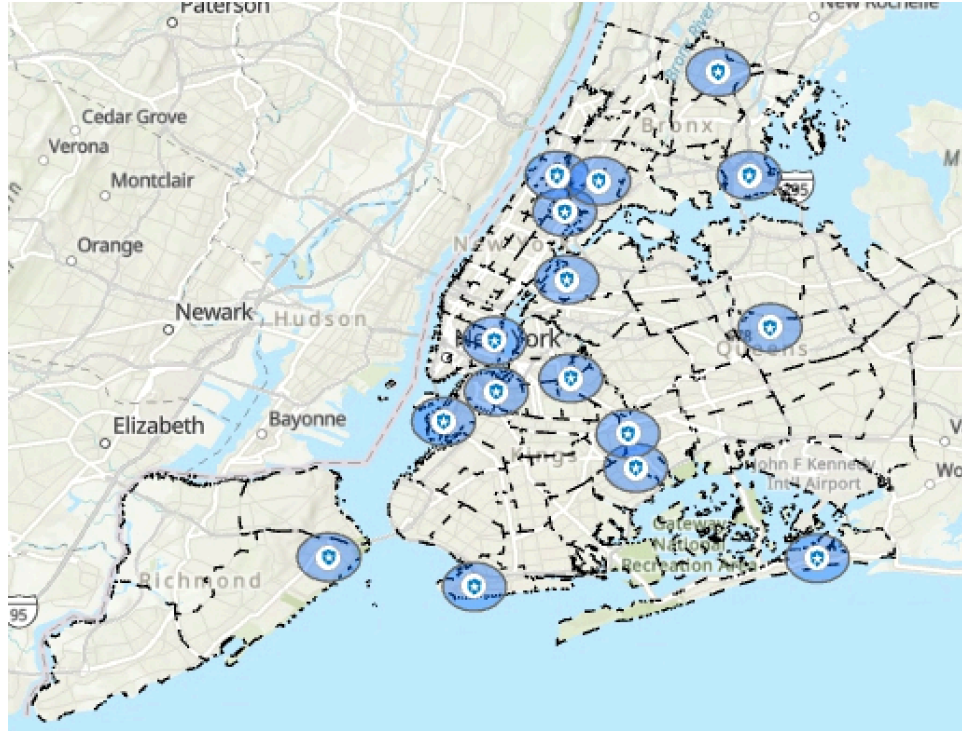
Map with Boroughs Polygon
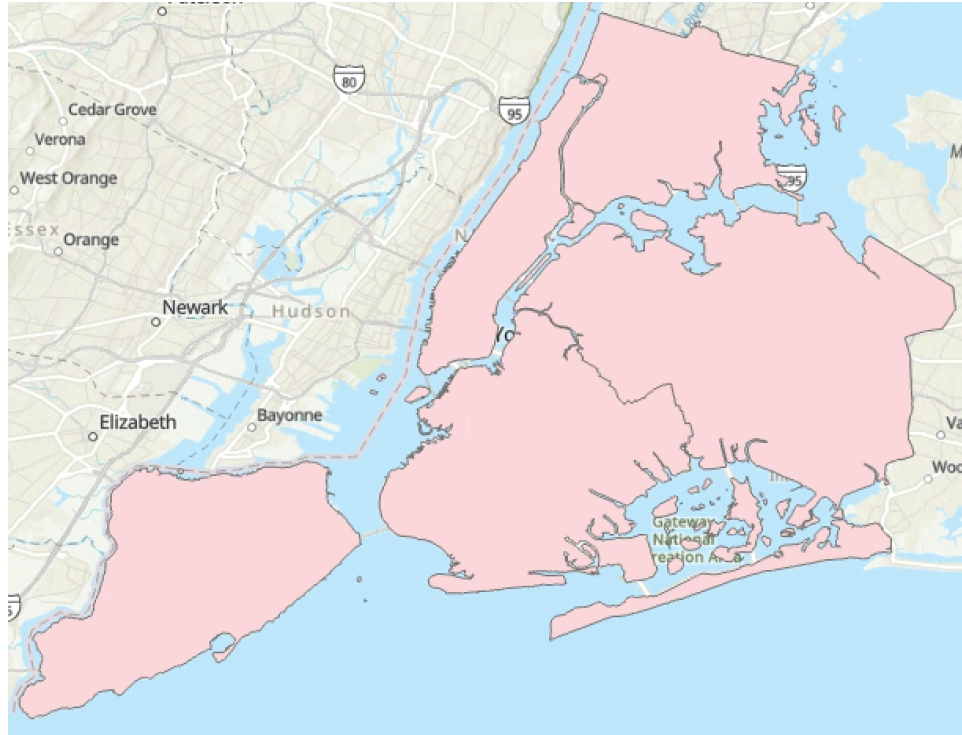
Next, we obtained a second shapefile containing 2010 Census Tracts. The purpose of this was to further narrow down the specific areas in which the crimes occurred, as we felt the boroughs were too large of an area. Because the dataset and shapefiles were pulled from a New York government website, the majority of the information was already cleaned up and ready-to-use.

Map with Census Tracts Polygon
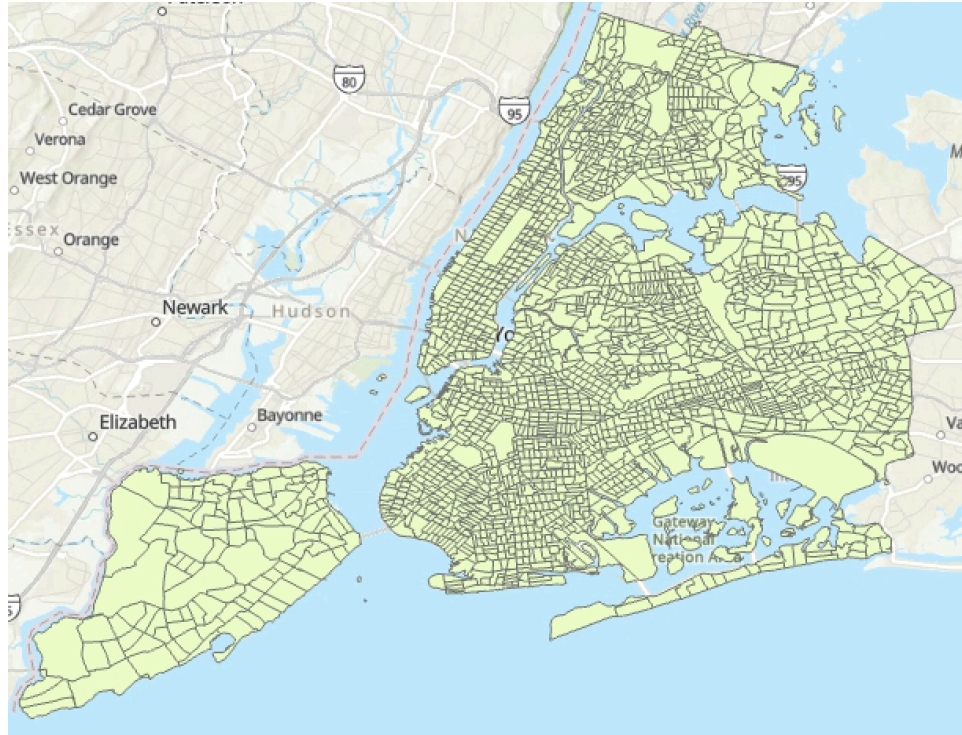
We played around with our feature layers and data points for a while, but we were having trouble developing a full story. So, after brining in those two shapefiles and analyzing our map, we developed new questions. We were curious if we could find out where actual police stations were located and whether or not they were close to or far away from current crime hotspots. We believed this would tell us how the NYPD could better allocate it's resources. We continued to search the NYC Open Source Data Website and exported two more shapefiles. The files we added to our map contained data that outlined police precinct boundaries and marked the locations of police service areas, which serve housing projects throughout NYC. After brining in all of this data, we felt ready to conduct our final analysis.

Map with Police Precinct Border Lines and Police Service Area Points

Original Data Source Table:

| Name	Short Description	Source	Features	Type
NYPD_Complaint_Data_ Current	Includes all valid felony, misdemeanor, and violation crimes reported to the NYPD	https://data.cityofnewyork.us/Public-Safety/NYPD-Complaint-Data-Current-Year-To-Date-/5uac-w243	N Rows: 306,656 N Columns: 36	Points
census_tracts_polygon	Map NYC's census tracts: 2010	https://data.cityofnewyork.us/City-Government/2010-Census-Tracts/fxpq-c8ku	N Rows: 2,165 N Columns: 13	Polygons
boroughs_polygon/ borough_border	Map of NYC's borough boundaries	https://data.cityofnewyork.us/City-Government/Borough-Boundaries/tqmj-j8zm	N Rows: 5 N Columns: 6	Polygons/ Lines
police_service_areas	Locations of NYPD's Police Service Areas	https://data.cityofnewyork.us/Housing-Development/NYCHA-PSA-Police-Service-Areas-/72wx-vdjr	N Rows: 16 N Columns: 6	Points
police_precincts_border	Outline of NYPD's police precints	https://data.cityofnewyork.us/Public-Safety/Police-Precincts/78dh-3ptz	N Rows: 77 N Columns: 5	Lines

Methodology

The methodology that we adopted for this analysis was sequential, and we progressed through by trial and error. We began simply by importing our dataset and creating feature layers by crime type. We differentiated the points by changing the color of their symbology and their layer names in order to better clarify the type of information and data we were displaying.

Map Displaying Misdemeanor Crimes Only
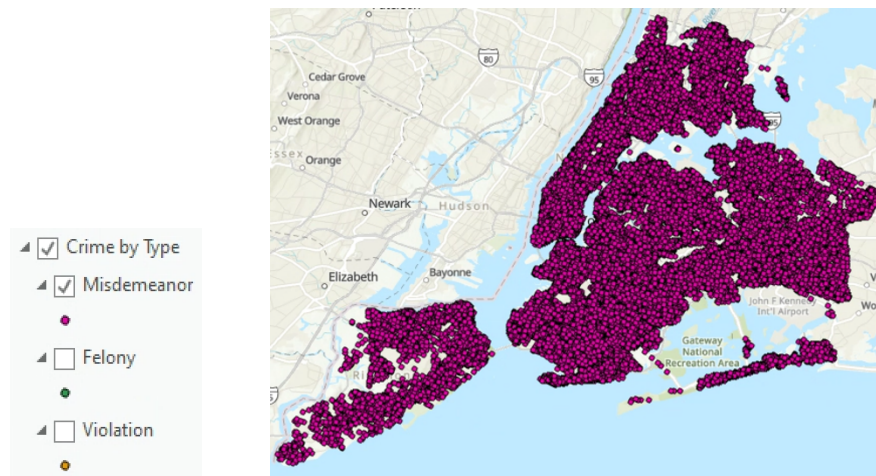
As previously stated in the Data Selection and Acquisition Section, we then brought in borough and census tract shapefiles to enhance our analysis. We performed spatial joins of the census tracts data with each crime by type feature layer. After doing so, we changed the symbology to graduated colors for better visualization.

Map of Misdemeanors by Census Tract
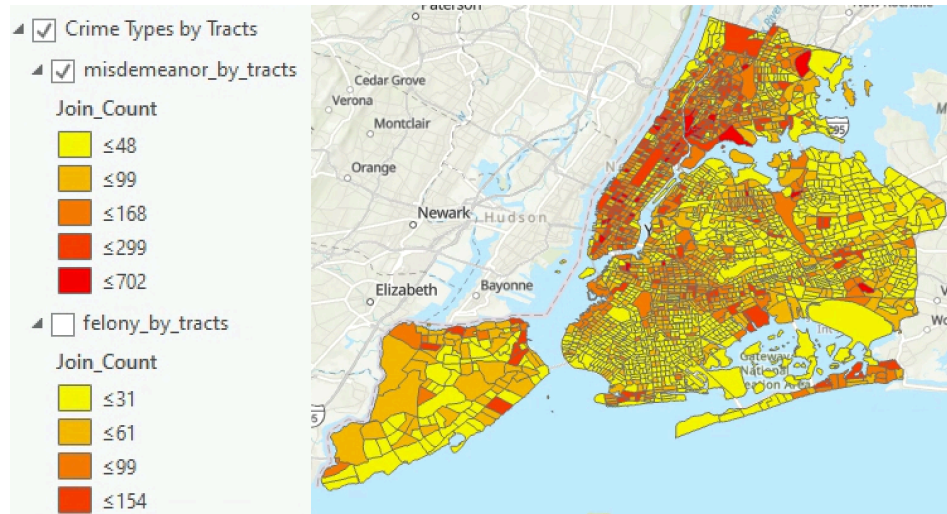
After completing this step, we then conducted an optimized hotspot analysis for each Crime Type by Tracts feature layer.

Misdemeanor Hotspot Analysis Separated by Borough
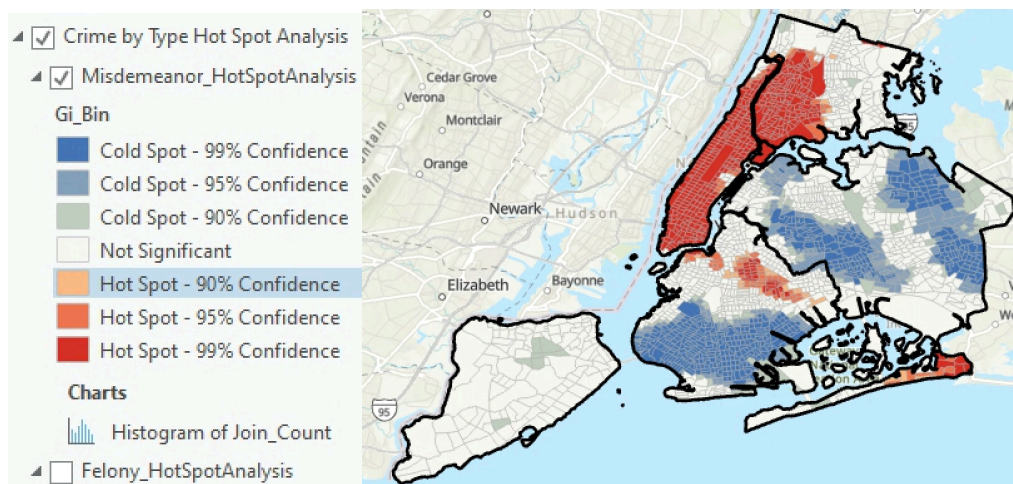
At this point in the analysis, we felt that our story was incomplete. We had played with the data for quite a while and created these hotspot maps, but it didn't tell us much, as there were very few discrepancies in the hotspots per crime type. As previously stated, this is when we brought in the police precinct and police service area data. Additionally, we further filtered our data to include all complaints, regardless of crime type, that occurred only in 2020, using the select by attributes tool. Then, we repeated the steps we had done before with our 2020 feature layer. We performed a spatial join with the

census tracts and changed the symbology to graduated colors again to visually display the join count of crimes occurring in each tract by color. Then we performed an optimized hotspot analysis on the 2020 crimes by tracts feature class. After doing so, we turned on our borough boundaries, police precinct lines, and service area markers and began analyzing the map for findings. It is worth noting that we created a 1 mile buffer around each police service area. After creating this map, we were able to draw significant findings, which we discuss in the section below.

Final Map Displaying 2020 Crime by Tracts Hotspot Analysis, Further Separated by Borough Border (solid black line) and Police Precints (dotted black line), and Marked by Police Service Area
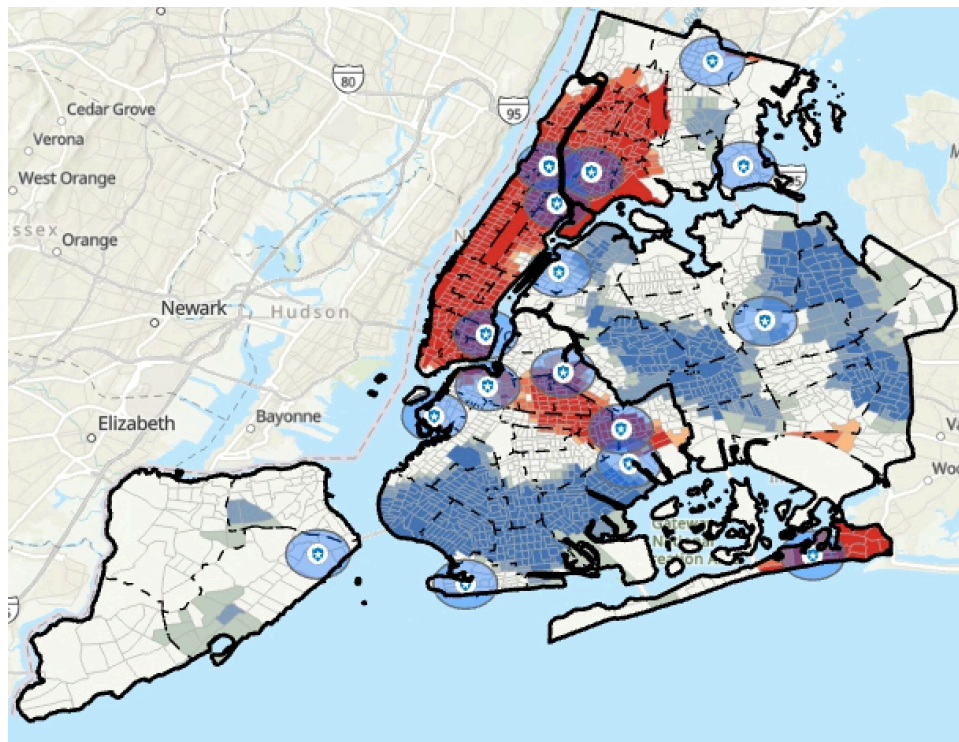
Results & Recommendations

In order to generate our final visualization, we conducted many steps. First, we obtained New York City crime data that contained locational data regarding felonies, misdemeanors, and violations. Second, we conducted a Hot Spot Analysis for each crime type to allow us to isolate violent crimes from non-violent crimes. Third, we incorporated New York City borough data into ArcGIS to allow us to add borders to the boroughs. This enabled us to observe locations with high risks for crime in certain areas, and it identified areas with the least risk of crim occurrence. Finally, we added the locations of New York's Police service areas. This provided City officials and the Police Department with an overview of the current layout that the Police Department currently uses.

These visualizations indicated that the Police Department had been attempting to locate their service areas near high-risk areas. However, the data also suggested that there is room for improvement in the location of their service areas. For example, there are three service areas on the Manhattan and Bronx border that all overlap each other. The southeast portion of the Bronx and almost the entire portion of Manhattan were identified as the largest hot spot, and have been allotted four total service areas.

Based on our findings and realistic inability to increase funding for more service areas, we recommend strategically moving multiple service areas to deploy resources more proportionally in hot spots. The service areas identified above should be moved to lower Manhattan, so that equal resources can be deployed throughout Manhattan more fairly. That said, the service areas will be located in a line throughout Manhattan until

its northern border with the Bronx. In addition, This will enable the service areas to react quicker to crime around Central Park and the southern areas more efficiently.

In addition, we recommend adjusting the location of the service area currently in Brooklyn's most southern region because the entire southern half of Brooklyn has been identified as a cold spot. We believe this service area should be moved to the northern side of the cold spot. This service are will still be able to deploy the necessary resources and react quickly enough to any crime that occurs within the cold spot. However, it will be closer to the hot spots and will be able to aid with its resources if an unusually high amount of crime occurs at any given time. Finally, there are several precincts located in cold spots and areas found to be insignificant. We believe it would be appropriate to strip back and defund policing in this area, and reallocate those funds to the communities, many of which are the locations of housing projects, as evidenced by the police service area markers. Funds pulled from these areas could also be put to use where current hot spots and heavy crime exists.

A proposal of the new service area layout:
The service area movement is indicated by a green arrow.
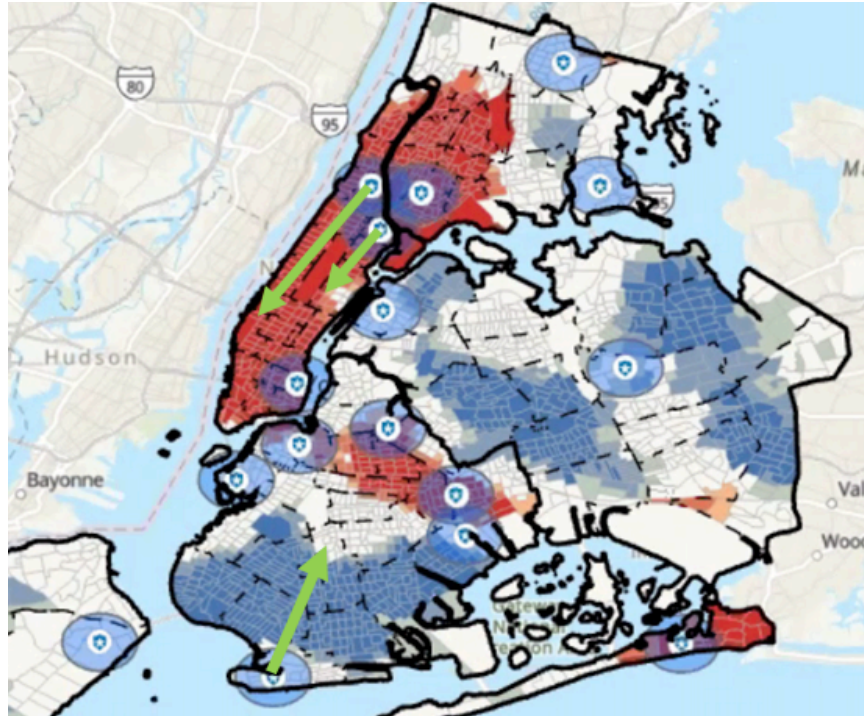
Conclusion

In conclusion, we found that there was a heavy mis-allocation of the police resources in areas where they did not need a high amount of investment. Rather it was more viable if there was a reallocation of the time, energy and resources towards the areas which required a stricter law enforcement. Along with that, shifting service areas so that they are strategically placed in the hotspots will allow them to respond quickly to the crime. As a result, it will lead to a lower response time. To the occurring crimes. In addition, we anticipated a higher number of hotspots all-across, but to our surprise, we found a significant amount of cold spots around the city. These cold spots had a higher allocation of police presence. Hence, we recommend the New York Police Department to reallocate the less engaged police servicemen. They should be transferred out of the cold spots to where their involvement is more needed. Beyond the service areas there are a

large number of police precincts located within insignificant and cold spot areas. So stripping back these precincts and reprioritizing the NYPD units to areas with higher number of crimes will increase the operational efficacy for law enforcement. Also, cutting back on the police precincts would end up saving a lot of the state resources which will make room for nourishing the communities such as bettering the public school system, improving the cleanliness of the environment, build better infrastructure, etc. Crimes occur when a society lacks development. Therefore, investing in the constructive measures will contribute towards the wholistic development of the society and create a healthy environment for the residents.

References

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